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PAIN INTENSITY MODERATES THE RELATIONSHIP BETWEEN AGE AND PAIN INTERFERENCE IN CHRONIC OROFACIAL PAIN PATIENTS

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Abstract

Background/Study Context—Chronic pain is associated with increased interference in daily functioning that becomes more pronounced as pain intensity increases. Based on previous research showing that older adults maintain well-being in the face of pain as well as or better than their younger counterparts, the current study examined the interaction of age and pain intensity on interference in a sample of chronic orofacial pain patients.

Methods—Data were obtained from the records of 508 chronic orofacial pain patients being seen for an initial evaluation from 2008 to 2012. Collected data included age (range: 18–78) and self-reported measures of pain intensity and pain interference. Bivariate correlations and regression models were used to assess for statistical interactions.

Results—Regression analyses revealed that pain intensity positively predicted pain interference ($R^2 = .35$, $B = 10.40$, $SE = 0.62$, $t(507) = 16.70$, $p < .001$). A significant interaction supported the primary hypothesis that aging was associated with reduced interference at high levels of pain intensity ($R^2 = .01$, $B = -1.31$, $SE = 0.63$, $t(505) = -2.90$, $p = .04$).

Conclusion—At high levels of pain intensity, interference decreased with age, although the age by pain intensity interaction effect was small. This evidence converges with aging theories, including socioemotional selectivity theory, which posits that as people age, they become more motivated to maximize positive emotions and minimize negative ones. The results highlight the importance of studying the mechanisms older adults use to successfully cope with pain.

INTRODUCTION

Chronic pain, defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage that has lasted beyond normal healing time (usually taken to be 3 months) is experienced by over 40% of community-dwelling older adults (Cook & Chastain, 2001; Ng, Tsui, & Chan, 2002; Rustøen et al., 2005). The prevalence of chronic pain steadily increases through age 65, after which it appears to level off (Andersson, 1994; Brattberg, Thorslund, & Wikman, 1989; Verhaak, Kerssens, Dekker, Sorbi, & Bensing,

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1998). Chronic pain is a significant health concern and is associated with mortality, reductions in quality of life, and increased feeling of fatigue (Boggero, Kniffin, De Leeuw, & Carlson, 2014; Mobily, Herr, Clark, & Wallace, 1994; Thomas & Roy, 1988; Torrance, Elliott, Lee, & Smith, 2010).

Some of the negative health consequences of chronic pain are attributable to the fact that pain interferes with the ability to perform daily activities (e.g., Putzke, Richards, Hicken, & DeVivo, 2002). Problems can be particularly pronounced in patients with chronic orofacial pain, for whom pain often interferes with the ability to perform fundamental human behaviors, including talking, eating, and expressing emotions (Okeson, 2005). The extent to which pain interferes with such behaviors largely depends on pain intensity (Osborn, Jensen, Ehde, Hanley, & Kraft, 2007; Serlin, Mendoza, Nakamura, Edwards, & Cleeland, 1995; Wells, 2000). There appear to be normative age-related decrements in endogenous pain modulatory systems and therefore increases in pain intensity as people age (Edwards & Fillingim, 2001; Edwards, Fillingim, & Ness, 2003). Older adults rated heat pain as more intense and more unpleasant than younger adults; likewise, older adults demonstrated impaired diffuse noxious inhibitory control that was interpreted to indicate impaired inhibitory ability (Edwards & Fillingim, 2001; Edwards et al., 2003).

If pain intensity contributes to interference, and people experience pain more intensely as they age, one would think older adults are destined for ongoing cycles of pain. To the contrary, however, older adults appear remarkably adept at psychologically coping with pain. Relative to younger pain patients, older pain patients report at least as good or better quality of life, marital and social satisfaction, and mood, despite experiencing higher chronic pain intensity (Cook & Chastain, 2001; Rustøen et al., 2005; Sorkin, Rudy, Hanlon, Turk, & Stieg, 1990; Thomas, Peat, Harris, Wilkie, & Croft, 2004). Whereas these studies suggest that older adults may be able to maintain psychological well-being in the face of chronic pain, extant studies have not tested whether the relationship between pain intensity and interference remains constant across the life span. Examining the interaction of age and pain intensity on interference may open the door for future research investigating the strategies older adults use to cope effectively with pain.

The current study builds on work suggesting that older adults are able to manage pain better than or as well as their younger counterparts by testing whether age interacts with pain intensity to predict pain interference. Based on the extant literature, it was hypothesized that the relationship of pain intensity with interference would be attenuated later in the life span, such that at high levels of pain intensity older adults would report less pain interference than their younger counterparts.

Additionally, previous work with chronic orofacial pain patients shows psychological differences among those with different types of orofacial pain. For instance, those with muscle pain report more affective complaints, more life stressors, and poorer sleep quality than those with intracapsular pain (Lindroth, Schmidt, & Carlson, 2001), and those with neuropathic pain report worse sleep and psychological functioning than those with muscle pain (Porto et al., 2011). Still others have not found psychological differences between different orofacial pain groups (Michelotti, Martina, Russo, & Romeo, 1998). Based on

these mixed findings, exploratory analyses were conducted in the current study to test whether the relationship between age and pain intensity differently predicts interference in muscle, joint, or neuropathic pain diagnoses.

METHODS

Participants

Data were obtained from the records of 521 patients being seen for initial examination at an orofacial pain center in the United States between 2008 and 2012. Missing data analyses revealed that 13 participants did not provide information on average pain intensity. There were no missing data for the age and pain interference variables. As such, analyses were conducted using the 508 participants who had data available for all study variables. Only participants experiencing pain for longer than 3 months were included to screen out those experiencing acute pain. All participants had orofacial pain as determined by a licensed dentist trained in the diagnosis of orofacial pain conditions. Participant primary diagnoses were as follows: muscle pain (37.6%), joint pain (29.3%), neuropathic pain (14.4%), and other (i.e., fibromyalgia, dental pain, cervical spine displacement, and no diagnosis; 18.7%). Seventy-eight percent of patients also had a secondary orofacial pain diagnosis. The diagnoses were established based on the guidelines from the American Academy of Orofacial Pain, 5th edition (De Leeuw, 2011). Mean age of the current sample was 46.1 years ($SD = 14.82$, range: 18–78), with 82.3% female ($n = 429$). Average pain duration at the time of initial appointment was 65.3 months ($SD = 92.8$).

Procedure

Patients completed a standardized battery of questionnaires as part of the routine intake protocol at the orofacial pain center where the study was conducted. Prior to filling out the battery, participants consented to their de-identified data being used for retrospective research purposes. The current study used this clinical record of de-identified data. As such, the Institutional Review Board waived requirement for informed consent for the current study but gave approval for the study to be conducted.

Measures

Pain Interference—The West Haven–Yale Multidimensional Pain Inventory (WHYMPI) is a widely used self-report measure that examines how pain impacts daily life across a variety of domains (Kerns, Turk, & Rudy, 1985). It was specifically designed for use in persistent pain populations and has been validated for use in patients with orofacial pain conditions (Andreu et al., 2006; Burckhardt & Jones, 2003). The WHYMPI is 52 items long and assesses functioning across 12 domains, with higher scores representing a higher level of the corresponding construct. In the current study, only the pain interference subscale of the WHYMPI was analyzed. The interference subscale is 9 items long and is designed to measure the extent to which pain which pain disrupts vocational, social/recreational, and family/marital functioning (e.g., “In general, how much does pain interfere with your day to day functioning?” “How much has your pain changed your ability to take part in recreational and other social activities?” Kerns et al., 1985, p. 349). Although pain-related disruptions in these domains apply across chronic pain conditions, they are sensitive to the disruptions in

eating, talking, and expressing emotions that characterize orofacial pain (Boggero & Carlson, 2015). Because the current study examined medical records that only contained scale scores and not individual item scores, internal consistency for the pain interference scale could not be computed. However, previous studies have shown the inference subscale to have high internal consistency in orofacial pain samples (Cronbach's $\alpha = .90$; Andreu et al., 2006; Burckhardt & Jones, 2003).

Average Pain Intensity—Participants were asked to rate their average levels of pain in the last month using a visual analog scale (VAS). Participants marked their level of pain on a 100 mm line with anchors of “No pain at all” and “The most intense pain you can imagine.” A ruler was then used to quantify the mark, resulting in a possible range from 0 to 100. Based on extant research, values of 25, 50, and 75 were used to represent clinically meaningful levels of low, medium, and high pain, respectively (Kelly, 2001).

Data Analysis Plan

All study variables were first checked for normality and outliers using the criteria of 3 *SD*. Bivariate correlations were conducted among all study variables. All variables were normally distributed, and no outliers were found for any of the study variables. An age by pain intensity interaction term was computed by converting variables to *z*-scores and multiplying these scores together. Regression models were tested with the main effect terms and the interaction term entered simultaneously. Significant interactions were probed using the online utility provided by Preacher, Curran, and Bauer (2006).

RESULTS

Table 1 presents the descriptive statistics and bivariate correlations among all study variables. Consistent with previous research, pain intensity and interference were strongly positively correlated with one another.

Hierarchical linear regression was conducted with pain interference as the outcome variable and age, pain intensity, and their interaction as the predictors. Main effect terms were entered in the first step, with the interaction term entered in the second step. Consistent with previous research, results revealed a significant main effect of pain intensity on interference ($R^2 = .35$, $B = 10.40$, $SE = 0.62$, $t(507) = 16.70$, $p < .001$). As predicted, there was also a significant age by pain intensity interaction in predicting interference ($R^2 = .01$, $B = -1.31$, $SE = 0.63$, $t(505) = -2.90$, $p = .04$). The effects of age were probed at values that extant research has established as corresponding to younger (30 years), middle-aged (45 years), late-middle-aged (60 years), and older (75 years) adults (Carstensen & Turk-Charles, 1994). Results revealed nonsignificant simple slopes of age at low levels of pain intensity ($B = 1.05$, $SE = 1.11$, $t(507) = 0.94$, $p = .35$) and at high levels of pain intensity ($B = -1.57$, $SE = -1.13$, $t(507) = -1.39$, $p = .16$). Note that these two simple slopes differed by >2.3 standard errors, indicating that for people with pain intensity approximately 75 and higher, the relationship between age and pain interference was different than it was for people with pain intensity approximately 25 and lower. Figure 1 illustrates the effect of age at different levels of pain intensity, with age categories corresponding to younger (18–30 years), middle-aged (30–45 years), late-middle-aged (45–60 years), and older (60–75 years) adults.

Exploratory Analyses

Hierarchical linear regression was used to test whether the relationship between age and pain intensity on pain interference differed between those with muscle, joint, and neuropathic pain. Those who received a primary diagnosis of “other” were excluded for these exploratory analyses. A three-way age by pain intensity by diagnostic group interaction term was computed. All main effect terms were entered in Step 1, two-way interactions terms in Step 2, and the three-way interactions in Step 3. Results revealed that there was not a significant change in explained variance by including the age by pain intensity by diagnostic group interaction, suggesting that the relationship between age and pain intensity on interference was similar across all three diagnostic groups ($R^2 = .00$, $F(2, 496) = 1.71$, $p = .18$).

DISCUSSION

The findings show that pain intensity moderated the relationship between age and pain interference such that at higher levels of pain intensity, older adults reported less pain interference than their younger counterparts. Although the age by pain intensity interaction effects were small, these findings contribute to previous literature showing that older adults are adept at maintaining psychological well-being in the face of pain by suggesting that they are also able to maintain daily activities in spite of pain. The fact that these findings were found with a population of orofacial pain patients, who are known to have high levels of life interference from pain, adds credence to the idea that older adults cope with pain as well as or better than younger adults. The findings are also consistent with socioemotional selectivity theory, which posits that as people age, they become motivated to increase positive experience and minimize negative ones (Carstensen, 1992; Carstensen, Isaacowitz, & Charles, 1999) and exhibit a positivity effect in which they implement conscious and subconscious strategies to maximize positive affect (Carstensen et al., 1999; Charles, Mather, & Carstensen, 2003; Fung, Carstensen, & Lang, 2001; Isaacowitz, Toner, Goren, & Wilson, 2008). The fact that older adults are motivated to achieve positivity and enact specific emotion regulation strategies to achieve that goal may help explain why older adults are able to curtail the effects of high pain intensity on life interference better than their younger counterparts. To our knowledge, no study to date has tested whether older adults and younger adults differ in their implementation of positivity mechanisms to cope with pain; future research in this area is warranted and would help clarify the mechanisms by which older adults learn to cope with chronic pain.

Exploratory analyses from the current study revealed that the interaction between age and pain intensity on pain interference was similar between different diagnostic categories of orofacial pain. Whereas previous research has found that those with neuropathic pain report worse psychological functioning than those with muscular pain, who in turn report worse psychological functioning than those with intracapsular pain (Lindroth et al., 2001; Porto et al., 2011), the results from the present study suggest that the age improves coping responses across diagnostic categories. These findings are consistent with others that have also been unable to find distinguishing factors between orofacial pain groups (Michelotti et al., 1998)

and suggest that age-related increases in the ability to manage chronic pain are transdiagnostic.

Limitations

The current study is not without limitations. It is important to note that all data were collected at a single time point and, as such, cannot serve to establish causality. The possibility that a third unmeasured variable accounts for the relationship described in the study cannot be ruled out. Another limitation is that age was examined cross-sectionally; results should be interpreted with this caveat in mind. As such, the findings cannot speak to how people's ability to curtail pain interference changes across their life spans. The cross-sectional nature of these data leaves open the possibility that cohort effects explain the obtained findings. To overcome these barriers, the observed relationships should be tested longitudinally in future research. Data for the present study were collected at the time of the appointment, and participants may have overreported their symptoms to ensure that the treating dentists understood their level of suffering. Also, pain was assessed using a single-item VAS scale which has uncertain reliability and may thus have attenuated the true effects (Boonstra, Preuper, Reneman, Posthumus, & Stewart, 2008). Finally, the present study only used people seeking treatment for orofacial pain disorders and cannot speak to whether people are equally able to cope with chronic pain in other parts of the body (e.g., lower back, knee, etc.).

Conclusions and Future Directions

Despite these limitations, the current study is novel in that it is the first to show that pain intensity moderates the relationship between age and pain interference in a sample of chronic orofacial pain patients. The sample size of the present study provided adequate power for small effects to be detected. The small effect sizes obtained do not mean that the described relationships are unimportant. Prentice and Miller (1992) argue that small effects can have big implications when the dependent variable is thought to be resistant to change. Pain interference falls in that category, and it poses a significant threat to quality of life for over 30 million adults in the United States—many of them older adults (Cortina & Chastain, 2001; Johannes, Le, Zhou, Johnston, & Dworkin, 2010). With the aging of and the high prevalence of chronic pain in the general population, we feel that any attempt to explain variance—even if only 1% of it—in pain interference has the potential to improve the quality of life for many people. The greatest value of the current results is that they illustrate the need of future research to explore *how* individuals minimize pain interference across the life span. What specific strategies do older adults use to cope with pain? Whereas socioemotional selectivity sets the groundwork for this future research by suggesting that older adults are motivated to maintain psychological well-being, the specific conditions of when, why, what, and how older adults accomplish this despite chronic pain remain to be explored. Such research has the potential for promoting quality of life and other psychological and physiological outcomes for older adults living with chronic pain disorders.

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Figure 1. The effects of age at different values of pain intensity
 Note: VAS = Visual analog scale.

Table 1

Descriptive statistics and bivariate correlations among study variables

Variable	1	2	3
1. Age	—	-.02	-.04
2. VAS pain intensity		—	-.60*
3. WHYMPI pain interference			—
Mean	45.85	50.39	46.07
Standard deviation	14.72	24.78	17.67

Note. VAS = visual analog scale; WHYMPI = West Haven–Yale Multidimensional Pain Inventory.

* Correlation is significant at the .01 level.